

<sup>(12)</sup> **UK Patent Application** <sup>(19)</sup> **GB** <sup>(11)</sup> **2 309 390** <sup>(13)</sup> **A**

**(43) Date of A Publication 30.07.1997**

**(21) Application No 9701343.7**

**(22) Date of Filing 23.01.1997**

**(31) 08591298**

**(32) 25.01.1996**

(33) US

**(71) Applicant(s)**

**Taylor Made Golf Company Inc**

**(Incorporated in USA - Delaware)**

**2271 Cosmos Court, Carlsbad, CA 92009,  
United States of America**

(72) Inventor(s)

**Dave Rose**

**William Priest**

(74) Agent and/or Address for Service

**A A Thornton & Co**

**Northumberland House, 303-306 High Holborn,  
LONDON, WC1V 7LE, United Kingdom**

(51) INT CL<sup>6</sup>

**A63B 53/04 53/00**

(52) UK CL (Edition O)

**A6D D23B**

**(56) Documents Cited**

**GB 2297916 A**

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**(58) Field of Search**

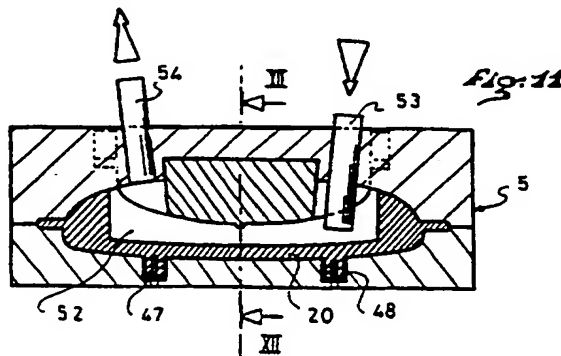
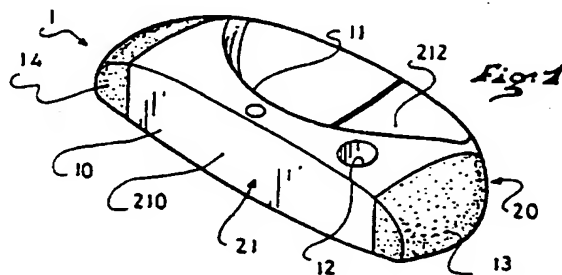
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INT CL<sup>6</sup> A63B 53/00 53/04

**(54) Putter and method of manufacturing golf club head**

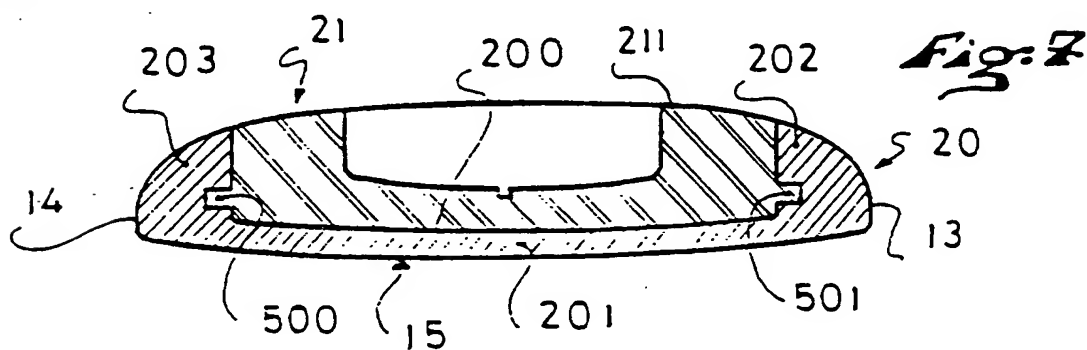
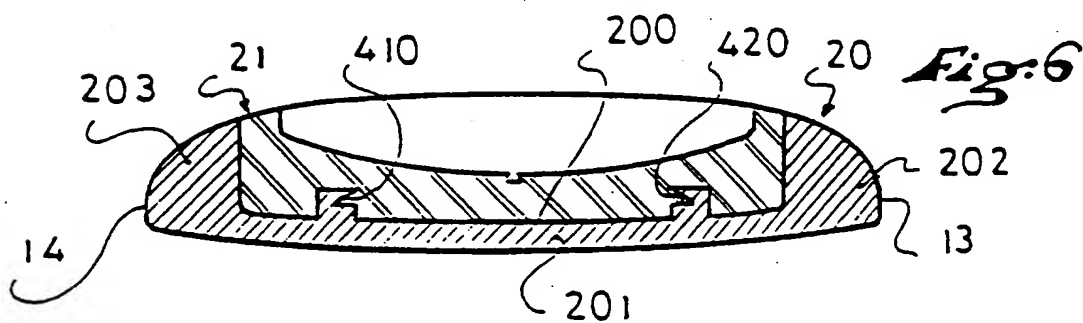
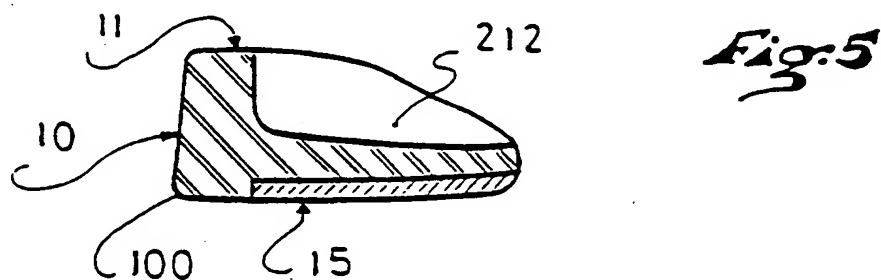
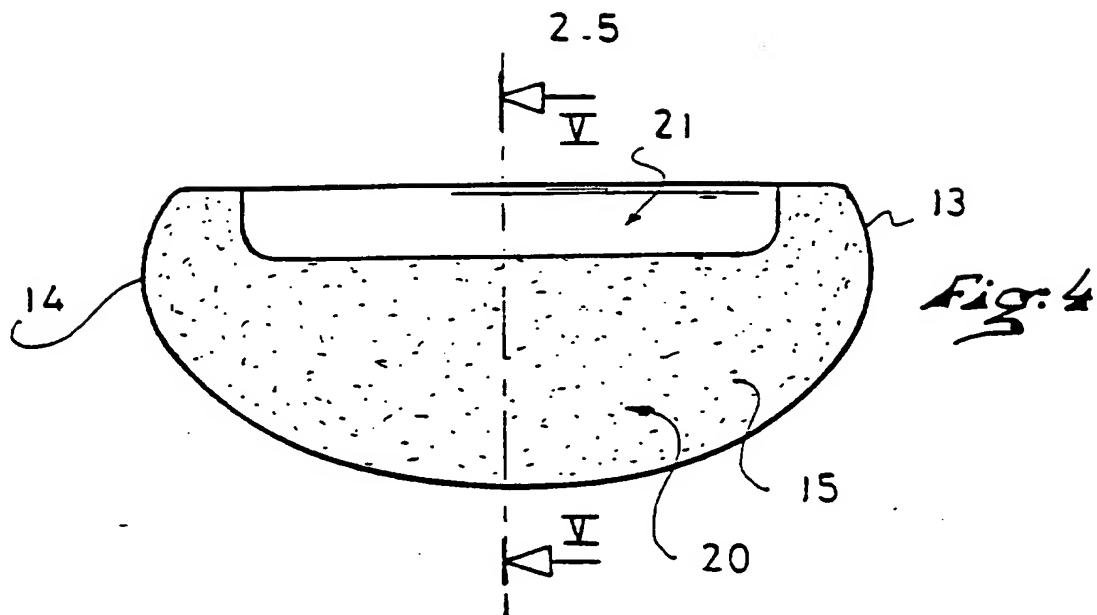
(57) A bi-metallic putter head comprises heel, toe and a major proportion of the sole made from a first higher density metallic material and the striking face and the rest of the body being made from a second lower density metallic material.

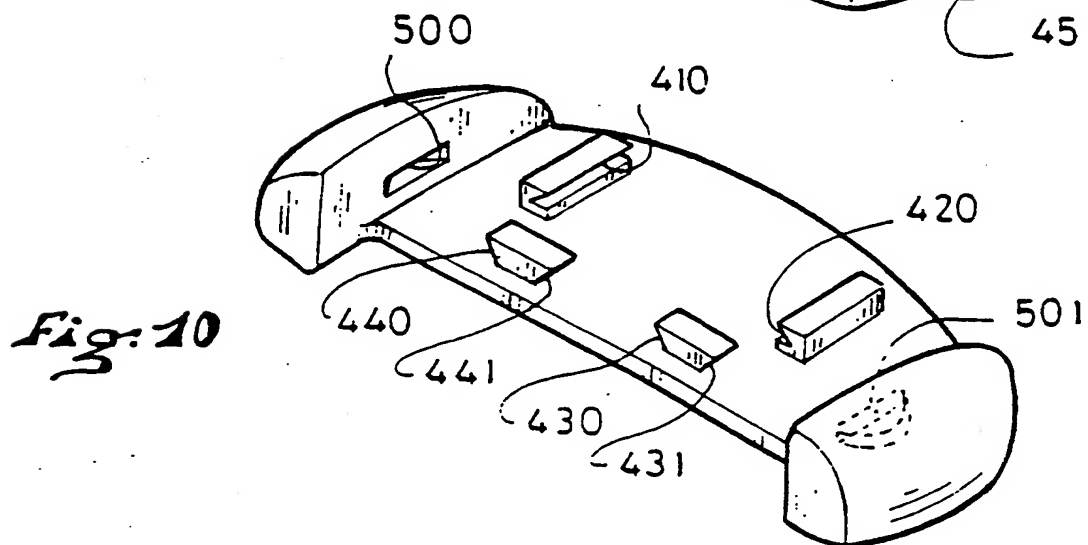
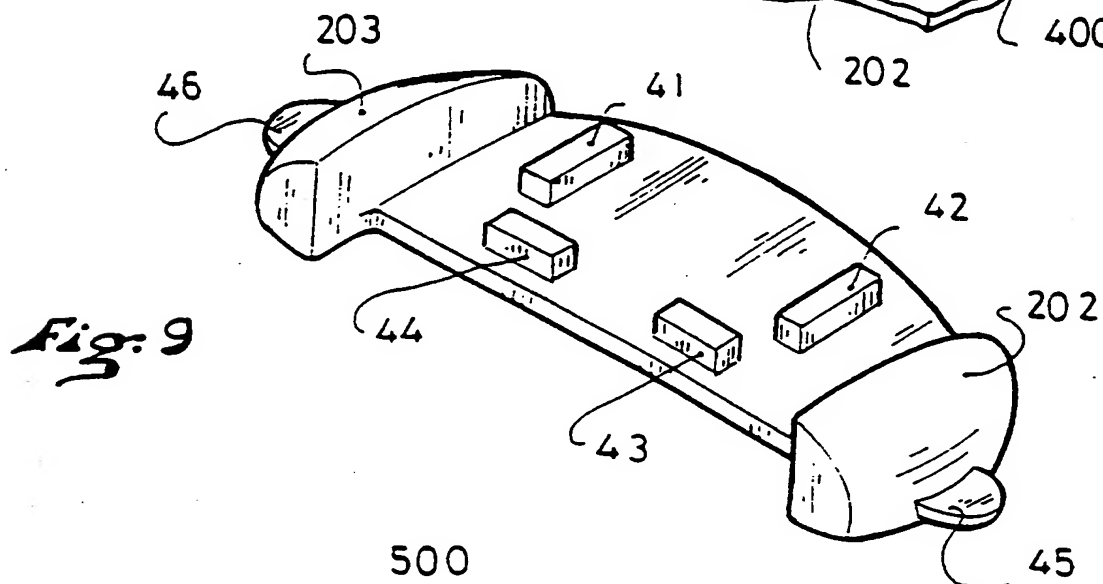
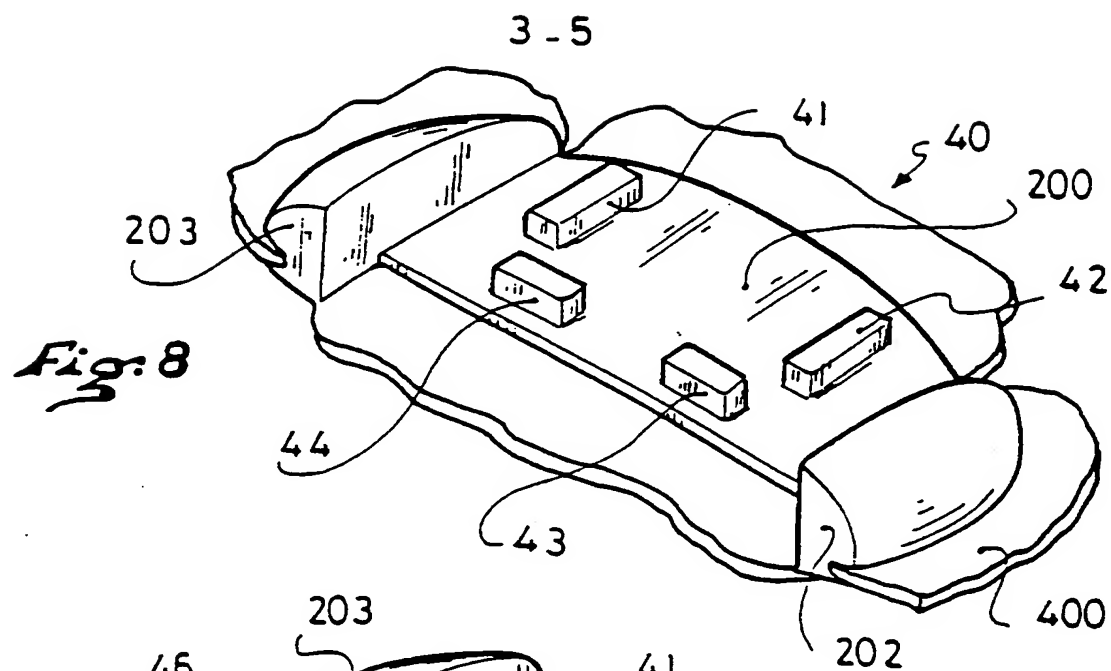
A golf club head can be made by shaping a first metallic element by forging a rough shaped piece, arranging the first element in a cast with free space casting a second element around the first element by injecting or pouring metallic material into the space, solidifying and removing the finished head.

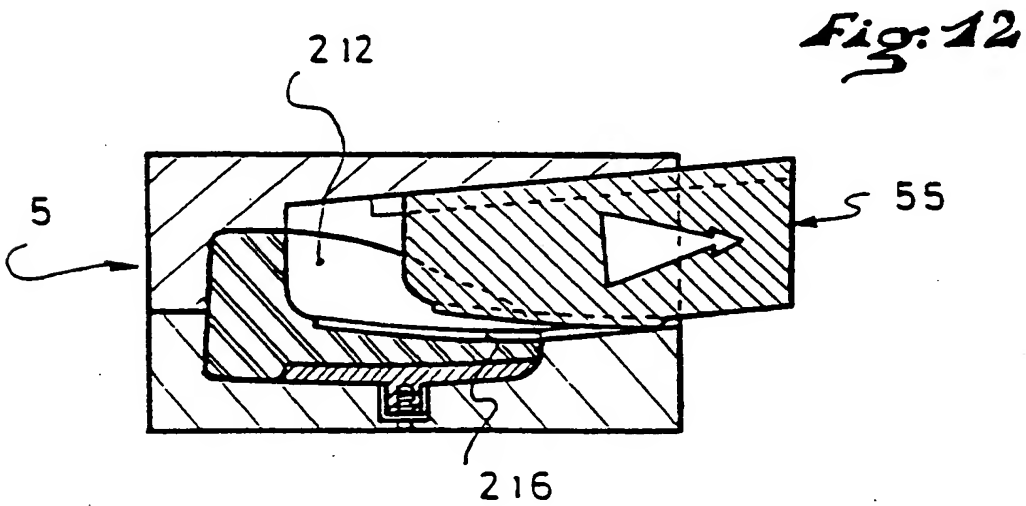
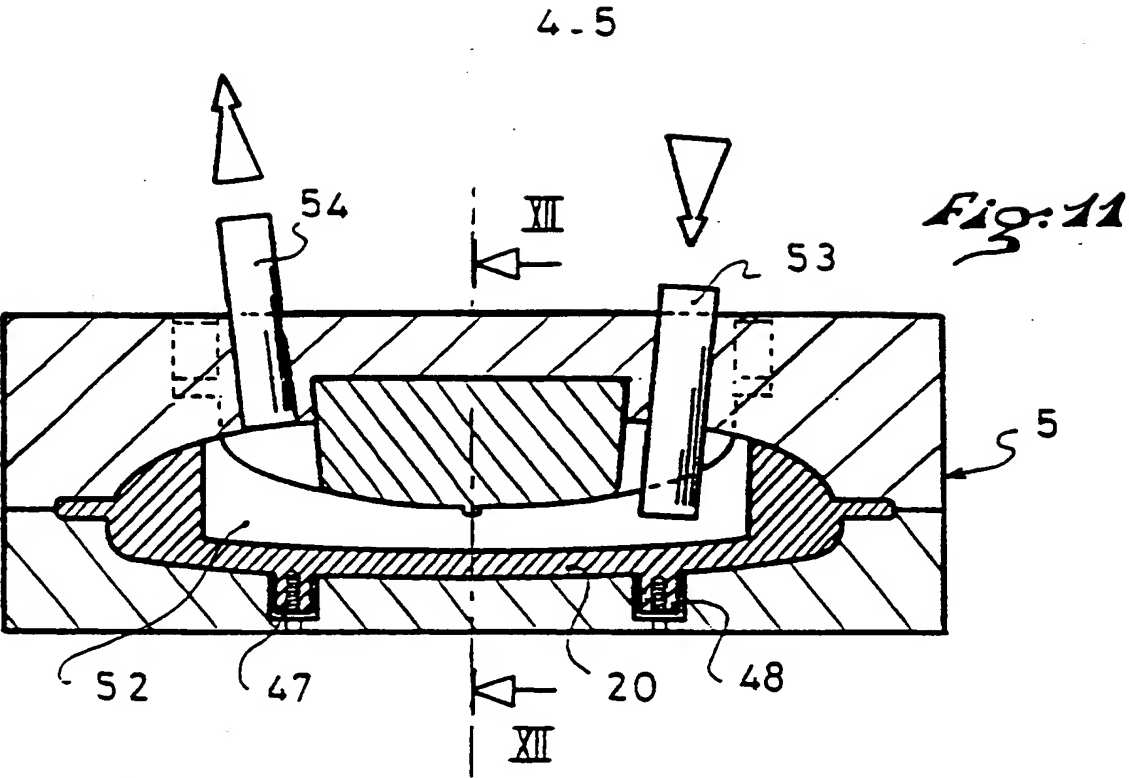


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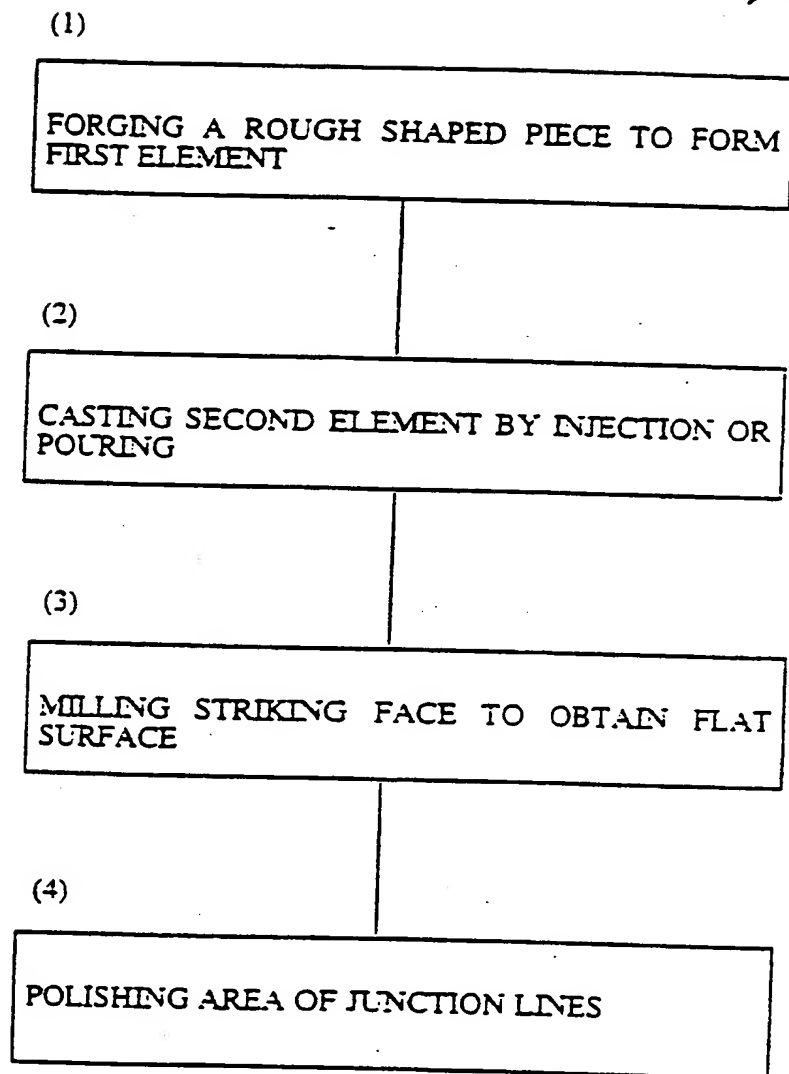






5.5

*Fig. 13*



## PUTTER AND METHOD OF MANUFACTURING GOLF CLUB HEAD

The invention is related in a general manner to the field of golf, and more particularly to a golf putter head of improved construction as well as an improved method of manufacturing a golf club head.

The head of a putter generally has the shape of an elongated mass that includes a striking face arranged substantially perpendicular to the horizontal or ground, which is used to strike the ball and cause it to roll on the green in an attempt to move it closer to the hole or, even better, into the hole.

It is recognized that off-centred strokes tend to cause a rotation of the face with respect to a starting position perpendicular to the intended trajectory. To reduce this twisting effect, an attempt has been made to construct heads by distributing the mass towards the ends of the heel and toe so as to increase the resistance to rotation by an increase of inertia. The constructions known from the prior art, however, are not completely

satisfactory. In the case of heads made out of one single amorphous material as in U.S. Patent No. 5,246,231, for example, heavy materials, such as brass, copper, or even cupro-beryllium, are generally chosen, and the volume of the toe and heel material is increased with respect to the centre face. The sensation upon impact on materials of high density is not very agreeable and it is very difficult to control the intensity and length of the stroke.

More sophisticated constructions call for light metallic or plastic structures extended at the ends by cavities filled by a metal of high density in the form of inserts, of screwed or affixed weights, or even steel balls, agglomerated powder, etc. U.S. Patent Nos. 4,655,459 and 5,340,107 are some examples among many others of such embodiments. The mass distribution is, however, not optimum for both reducing the tendency for rotation of the head and promoting the top spin to cause the ball to roll and to control the trajectory and length of the ball.

Accordingly to one aspect the present invention provides a putter head comprising

- (a) a first body element formed of a first metallic material of relatively high density constituting at least the heel portion, the toe portion and a major portion of the surface of the sole;
- (b) a second body element intimately linked to the first element and formed of a second metallic material of lower density than



the first metallic material, the second body element covering the remainder of the head including at least the central portion of the striking face thereof.

The putter head of the invention can allow optimised mass distribution that resists the twisting effect during off-centred strokes whilst gaining a top spin effect by a meshing/gearing effect that improves the rolling of the ball and therefore improves the control thereof. In addition the club head can have an impact sensation that is both soft and solid by choosing an appropriate material that is different from than that used to be principally distribute the mass.

From the specific assembly of two elements made of materials having different densities, one promotes an optimal heel/toe distribution of mass by increasing the moment of inertia of the head and by reducing the twisting effect, and one also lowers the centre of gravity of the head to promote the top spin effect on the ball.

According to a preferred embodiment of the invention:

- (a) the first element has a U-shaped cavity with a base forming a major portion of the sole, which is laterally prolonged by two wings extending upward and rearward forming the heel portion and toe portion, respectively;
- (b) the second element has a shape complementary to the shape of the cavity of the first element, including a front portion

constituting the major portion of the face, and that extends toward the rear by a central portion and adjusts in the cavity of the first element.

The first element manages the mass distribution by reason of its U-shape. The second element made out of a suitable material ensures the restitution of touching sensations with the ball. According to a complementary characteristic, the first element is made as one single piece in the course of a single operation by the forging technique, and the second element is a piece cast in place in the cavity of the first element.

According to another aspect the invention provides a method of manufacturing a bi-material club head, which method includes the steps of:

- (a) shaping a first element by forging a rough piece in a first metallic material;
- (b) arranging the first element in a cast creating a free space between the surfaces of the first element and the walls of the cast; and
- (c) casting a second element in intimate connection with the first element by injecting or pouring a second material into the volume of the free space; and
- (d) removing the head from the cast after solidification of the second element.

The assembly thus obtains forms of homogenous and perfectly solid unitary block. This assembly technique is economical and offers large possibilities for embodying original distinctive forms. It allows the production of heads in large series without a manual assembly operation.

According to a proffered feature, step (a) includes the formation of an open cavity in the first element into which at least a portion of the second element is poured or injected during step (c).

The invention will be better understood with the help of the detailed description that follows, reference being made to the annexed drawings, in which:

Figure 1 is a perspective view of the putter head according to the invention;

Figure 2 is a top view of the head of Figure 1;

Figure 3 is a front view of the head of Figure 1 during the mounting of a shaft;

Figure 4 is a bottom view of the head of Figure 1;

Figure 5 is a cross-sectional view taken along line V-V of the head of Figure 4;

Figure 6 is a cross-sectional view taken along line VI-VI of Figure 2;

Figure 7 is a cross-sectional view along line VII-VII of Figure 2;

Figure 8 shows the rough piece of one of the elements of the head after forging according to the manufacturing method of the invention;

Figure 9 shows the rough piece of Figure 6 after deburring;

Figure 10 shows the rough piece of Figure 6 at a yet more advanced finishing stage before the injection of the second element;

Figure 11 is a cross-sectional view in the injection cast;

Figure 12 is another cross-sectional view taken along line XII-XII of Figure 11; and

Figure 13 shows a schematic diagram of the method of the invention.

The putter head embodying the invention and shown in Figures 1-5, has a body 1 having a portion of a substantially vertical striking surface 10, a front or top portion 11 in which a hole 12 is provided for the passage of a shaft, a heel portion 13, an opposite toe portion 14 and a sole portion 15. According to one aspect of the invention, the head is constituted by an assembly of two distinct elements, a first element 20 of the body formed of a first metallic material of high density and a second element 21 of the body formed of a second metallic material that has a lower density than the first material.

The first element 20 forms the heel 13 and the toe 14 portions

as well as a major portion of the surface of the sole 15. The second element forms the remainder of the body with the major portion of the striking surface 10 and a central portion of the top portion 11 of the head.

As shown in the cross-sections of Figures 6 or 7, the first element 20 has a cavity 200 with a general U-shape that defines a substantially horizontal elongated base 201 forming a portion of the sole 15 and that is prolonged laterally by two wings 202, 203 extending upward and rearward from the face 10 and forming the heel 13 and toe 14 portions, respectively, of the head.

From this particular geometry, the mass distribution is thus favoured in the heel/toe to procure a substantial moment of inertia with respect to the vertical axis passing through the centre of gravity and a distribution on the sole to lower the centre of gravity to the maximum.

The second element 21 has a shape complementary to the first element 20 with a front portion 210 that occupies the face portion 10 on its entire height and a large portion of the width of the face that substantially corresponds to the distance separating the two wings 202, 203 of the first element and extends toward the rear by a central portion 211 that adjusts in the U-shaped cavity 200 of the first element. The attack or lead edge 100 of the face is therefore constituted by the material of the face that must have a substantial hardness to be capable of resisting the scratches against the ground.

As shown in Figures 1 and 2, the central portion 211 comprises a recess 212 that is open toward the top and toward the rear in such a way as to create a reduction of thickness of the material in the central portion. This also favours the lowering of the centre of gravity but also serves to help the alignment by reason of its shape. More precisely, the recess 212 has an edge 213 having a curved shape in which the concavity is directed toward the front in the direction of the face 10. The edge 213 is a portion of an arc 213 that has a radius  $R$  whose origin  $O$  is aligned along a line 214 perpendicular to the plane of the and face passing through the face centre 215. The value of this radius  $R$  is substantially equivalent to that of the radius of the hole on the green.

It should be noted that the alignment system can be improved by providing a recessed or raised rectilinear marking 216 in the and of the recess 212 and merging with line 214.

For evident reasons of fabrication simplicity, the head has a perfect symmetry with respect to the median vertical plane  $P$  passing through the face centre 215. One can thus use the same fabrication tools for putters intended for left-handed or right-handed players. The only change between a left-handed or right-handed arises from the positioning of the hole 12 that is necessary to provide on either side of plane  $P$ .

Figure 3 shows the adaption of the end of a shaft 3 in the hole 12 provided for this purpose to complete the assembly of the putter, the

shaft having an appropriate grip applied thereto. The assembly is achieved by means of a rapid cross-linking glue, for example.

The material constituting the first element is preferably chosen among copper or a copper-rich alloy for its high density in the vicinity of 8.85 and its good workability necessary for the implementation of the forging technique.

Other materials, however, such as tungsten, brass, or beryllium-copper can be used.

The material comprising the second element is preferably chosen among aluminium or aluminium-rich alloy for its lightness (density about  $2.7 \text{ g/cm}^3$ ) and its good castability. Aluminum 6061 is preferred in the scope of the best embodiment. In the same manner, one can envision the use of another material of low density such as Titanium, beryllium, or magnesium.

The invention likewise is related to the method for manufacturing the putter head, the putter, adapted in particular to the type of construction just described.

This method involves the steps indicated by the diagram of Figure 13, and is illustrated specifically by Figures 8-10. It first includes the formation of the first element by forging of a rough shaped piece 40 as shown in Figure 8. One thus hot forges in a cast, in the course of a single phase, the element with its cavity 200 edged with flanges or wings

202,203. During this step, a plurality of raised hooking or securing means 41, 42, 43, 44 is formed in the bottom of the cavity, such hooking means being adapted to improve the anchoring of the second element on the first to subsequently form an assembly or intimately solidary body.

The forging operation also leads to the formation of burrs 400 that are eliminated by cutting during the second phase (Figure 9). In the course of this operation, retention means 45, 46 adapted to improve the positioning and the immobilisation of the element in the pouring cast during the following step are preserved. Then, the surfaces and the edges of the cavity 200 are rectified by milling to ensure a proper flatness and surface state improving the hooking. The sole of the forged element comprises a plurality of raised pins 47, 48 threaded to keep the piece immobilised during the milling operation. Notches 410, 420, 430, 431, 440, 441, 500, 501 are obtained by milling in the hooking means 41, 42, 43, 44 and in the surface of the cavity, for example in the internal surfaces of the wings 202, 203. The notches help to improve the binding of the elements 20, 21 between them; the material of the second element filling said notches during pouring (Figures 6 and 7).

Figure 11 shows the pouring step of the second element in the free space 52 after the arrangement and the maintenance of the first element 20 in the injection cast 5. The injection step includes the introduction, under a high pressure, the melting metallic material,



preferably aluminium 6061, into the volume 52 provided in the cast.

The injection pressure is on the order of 150-200 tons/m<sup>2</sup> under a temperature of about 700°C. This step includes the formation of hole 12 for the shaft in its definitive shape and dimensions. For this, one provides the introduction of a shaft 53 with an appropriate diameter and length into the cast 5. The injection device can comprise two opposite shafts 53, 54: shaft 53 in an introductory position and shaft 54 in a retracted position, or inversely, for the construction of a right-handed head or inversely for a left-handed (Figure 11). No finishing operation is necessary in the hole.

Likewise, during the pouring a cast element mounted on a slide 55 is indexed in position and is retracted outside of the cast 5 after solidification and ejection of the head from the cast. This permits the formation of the rear recess 212 and of the aiming slit 216. This cast element 55 must have at least one angle of around 10° with respect to the horizontal to be able to form the recess and to be easily retracted.

After the opening of the cast and ejection of the piece, one proceeds to finishing operation that includes:

- a step in which one rectifies by milling of the striking surface 10 to obtain a flat surface,
- a cutting or emerizing/grinding with emery of the retention means 45, 46 and pins 47, 48, and lastly,

- a second polishing step of the surfaces, in particular, at the level of the junction lines between the first and second elements.

Although the invention has been described with reference to particular means, materials, and embodiments, it to be understood that the invention is not limited to the particulars expressly disclosed, but the invention extends to all equivalents within the scope of the claims that follow.

**CLAIMS:**

1. A putter head comprising:
  - (a) a first body element formed of a first metallic material of relatively high density constituting at least the heel portion, the toe portion and a major portion of the surface of the sole;
  - (b) a second body element intimately linked to the first element and formed of a second metallic material of lower density than the first metallic material, the second body element covering the remainder of the head including at least the central portion of the striking face thereof.
  
2. A putter head according to claim 1, wherein:
  - (a) the first element has a U-shaped cavity with a bottom forming a major portion of the sole and extended laterally by two wings extending upward and toward the rear forming the heel portion and the toe portion, respectively; and
  - (b) the second element has a shape complementary to the shape of said cavity of the first element and includes a front portion constituting the major portion of the face, and a central portion extending towards the rear within the cavity of the first element.

3. A putter head according to claim 2, wherein:  
the first element is obtained by forging and the second element is a piece cast in place in the cavity of the first element.
4. A putter head according to claim 3, wherein:  
the bottom of the cavity of the first element is provided with hooking means for anchoring the second element cast in the cavity.
5. A putter head according to claim 2, 3 or 4, wherein:  
the central portion of the second element comprises a recess open upwardly and toward the rear for creating a reduction in thickness of material of the central portion.
6. A putter head according to claim 5, wherein:  
the recess has a curved edge in which the concavity is directed forwardly toward the striking face.
7. A putter head according to claim 6, wherein:  
the curved edge is a portion of an arc having a radius of curvature whose origin is positioned along a line perpendicular to the plane of the face and passing through the centre of the

face, the radius of curvature having a value substantially equivalent to that of the radius of the hole on a green.

8. A putter head according to any one of claims 1 to 7, wherein: the head has a perfect symmetry with respect to the vertical median plane passing through the centre of the striking face, and the second element is provided with a hole positioned in the vicinity of the heel portion for the introduction of the lower end of a putter shaft.
9. A putter head according to any one of claims 1 to 8, wherein: the material constituting the second body element comprises aluminum or aluminium alloy.
10. A putter head according to any one of claims 1 to 9, wherein: the material constituting the first element of the body comprises copper or copper alloy.
11. A putter comprising a putter head according to any one of claims 1 to 10 having a shaft connected thereto.
12. A method of manufacturing a bi-material club head, the method

comprising the steps of:

- (a) shaping a first element by forging a rough shaped piece in a metallic material;
- (b) arranging the first element in a cast creating a free space between the surfaces of the first element and the walls of the cast;
- (c) casting a second element in intimate connection with the first element by injecting or pouring a second material into the volume of the free space; and
- (d) after solidification in place of the second element, removing the head from the cast.

- 13. A method according to claim 12, wherein:  
step (a) includes the formation of an open cavity in the first element, and at least a portion of the second element is poured or injected into the cavity during step (c).
- 14. A method according to claim 13, wherein:  
step (a) includes the formation of a plurality of raised hooking means in the cavity to improve the anchoring of the second element to the first element to form a solid intimate assembly.

15. A method according to claim 14, wherein:  
after forging of the first element, notches are formed by machining the hooking means and/or the surface of the cavity.
16. A method according to any one of claims 12 to 15, wherein:  
after step (d) finishing operations are performed including:-
  - milling the striking face to obtain a flat surface; and
  - surface polishing, in particular in the area of the junction lines between the first and second elements.
17. A method according to any one of claims 12 to 16, wherein:  
during step (c) a hole for the introduction of a club shaft is formed in its definitive shape and dimensions during pouring or injection.
18. A method according to any one of claims 12 to 17, wherein:  
step (c) includes the formation of a rear recess open upwardly and toward the rear of the head, obtained by a movable cast insert mounted in position on the cast during the pouring of the second material and retracted outside of the cast after solidification to facilitate ejection of the head from the cast.

19. A putter substantially as herein described with reference to the accompanying drawings.
20. A method of manufacturing a golf club head substantially as herein described with reference to the accompanying drawings.





Application No: GB 9701343.7  
Claims searched: 1 to 11, 19

Examiner: Alan Blunt  
Date of search: 11 April 1997

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): A6D (D23B)

Int Cl (Ed.6): A63B 53/00, 53/04

Other:

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
A	GB2195086A (WAITES) - whole document	1
X, Y	US5482281 (ANDERSON) - whole document	1 to 11
&	GB2297916A (KARSTEN)	
Y	US4824115 (WALTHER) - whole document	1 to 11

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.